

An enhanced-automated-array method for earthquake detection and location and its application on the Preparatory Phase of the Mw 8.2 Iquique Earthquake, Chile 2014

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Automated methods for detection and location are more and more used in seismology, given the size of arrays and the quantity of data-set to process. Among these methods, some compute the statistical distribution of a signal trough time in order to emphasize the seismic onsets [Saragiotis 2002; Baillard et al. 2014]. The Multi-Band Backprojection method [Poiata et al. 2016] use high-order statistics to build seismic arrival characteristic functions for each station of a given network. These functions are cross-correlated between stations, and the resulting correlation function is back-projected on a 3-D time-lag grid according to a given velocity model, and stacked for all pair of station. A coherent source will make the stacked time-lag grid focus at the source location.

This method already proved its efficiency for building large catalogues [Aden-Antoniow et al. AGU 2015]. However the resolution of the location of a coherent source is very sensitive to outliers onsets in the same time window, in particular those due to other earthquakes. Here we further develop our method in order to improve event picking and location, in particular for events clustered in time. We filter each time-lag grid by the stacked time-lag grid computed during a first round, which allows to keep only the most coherent source across the network on each correlation function. Then we back-project it onto the 3-D hypocenter space, transform it into probability density functions (pdf), and combine these pdfs for each stations pair on the 3-D hypocentral grid. This processing improves the location of seismic sources and better quantifies its uncertainties, as well as the picking of the seismic onsets themselves.

We apply this improved processing methodology to the data set provided by the IPOC and ILN seismic networks, covering the 3 months of the preparatory phase of the 2014, M=8.2, Iquique earthquake (Chile). We then compare the resulting hypocenter catalogue to the one which we generated with the first, simpler version of the method, to qualify the efficiency of this new step in the methodology.